Guidelines For Terrestrial Noxious Weed Mapping And Inventory In Idaho

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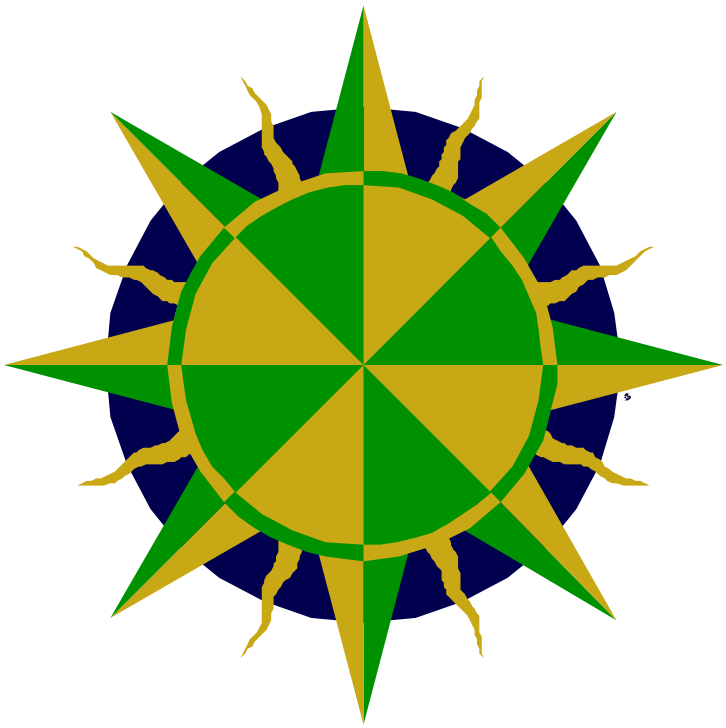

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BACKGROUND:

In Idaho, the control of noxious weeds is the responsibility of the landowner with the county governments as the enforcement authority. Idaho is 64 percent federally owned with 5 percent state lands, and 31 percent private lands. With diverse and often divergent management strategies, it is often difficult to keep noxious weed managers on the same page. Noxious weed data has been held in different formats, collected with varying levels of accuracy, and defined differently for things such as infestation size and density. Historically, it has been difficult to exchange noxious weed location information between different federal, state, and local government organizations when there was interest.

To attempt to estimate statewide numbers in the past, the Idaho State Department of Agriculture (ISDA) required an annual report from the counties that used broad categories to define acreage. These numbers were infrequently requested. Locally, managers rarely placed an infestation location on a paper map and they did not map infestations electronically since the technology was not available to them. Occasionally, location descriptions may be found on Pesticide Application Reports. Acres were often recorded as the size of the field sprayed, not an indication of the size of the weed infestation. Weed control was monitored by acres of road sprayed, by enforcement requests, or by profit. Little emphasis was placed on identifying weed locations or sizes.

With the continuing reduction in costs for hardware and software, as well as the pervasiveness of computer based technology in the workplace, the time is right to move to coordinated weed mapping efforts. Currently, there are some standards in place, and more are developing. The ISDA recommends and uses the standards created by the North American Weed Management Association (NAWMA) with the recommendations and additions made by the Idaho Noxious Weed Coordinating Committee's mapping sub-committee.

Demand has increased for vegetation map products from all types of agencies and business and it is expected that there will be a continuing trend toward storing all weed inventory and monitoring information in Geographic Information Systems (GIS). With the use of GIS, the use of Global Positioning Systems (GPS), and mobile computing to assist with the inventory and monitoring should also increase. It is hoped that these guidelines will serve as a place for collaborators and partners to coordinate and/or start their mapping efforts. It is also expected that many will add requirements specific to their programs to these guidelines. ISDA will continue to promote the use of mapping technologies on the local level, the use of accepted standards by all parties involved in weed management, and cooperation and coordination between all parties involved in weed management.

PURPOSE OF GUIDELINES:

The purpose of this document is to describe the guidelines for noxious weed mapping recommended by ISDA.

ISDA NOXIOUS WEED MAPPING PROGRAM

The Idaho State Department of Agriculture's (ISDA) noxious weed mapping program promotes the use of mapping technologies at the local level and the sharing of that information across jurisdictional boundaries. ISDA's mapping program provides in-office support, technical assistance, and limited training on GPS and GIS. The program is dedicated to assisting with the development and use of data collection and dissemination standards to be utilized by all land managers and land owners statewide.

Goals of ISDA Noxious Weed Mapping Program:

- To construct a yearly picture of noxious weed infestations in the state of Idaho
- To promote the use of mapping technologies on the local level
- To promote the sharing of noxious weed location information across jurisdictional boundaries
- To ensure that the developed standards are compatible with national standards
- To develop and conduct training on the use and application of such standards

WHY MAP?

What is mapping?

Everyone knows intuitively what a map is, but not everyone can define it. Many of us use maps everyday. If you want to ride the bus, try to find that new restaurant in town, or meet your friend at a favorite fishing hole, a map is usually involved. But what IS a map? Basically, a map is a generalized, graphic representation of the real world. Objects represented on maps are called features. Two common map features include airplanes for airports and blue lines for streams. Simply put, mapping is assigning designated features onto other, more familiar features to create a "picture" of a real world situation. The real world situation many weed control personnel are interested in is the distribution and severity of noxious weed infestations currently and through time.

Mapping is an important component of a weed inventory. Mapping indicates the extent and location of a weed infestation, and when combined with other information about a species including severity and density, constitutes a weed inventory.

Why Map Weeds?

A common argument is "I do not need to map weeds. I see a weed and I kill it." But how do you evaluate your efforts? Maps are the way that you document that a weed was there, that you looked for it again, and you never saw it there again. A weed map with basic survey information will allow you to evaluate the results of control measures. A noxious weed location map with information on size and density of an infestation is also critical for planning control efforts. Integrated Pest Management involves using the most efficient control methods. It is very difficult to determine what methods are the most effective and efficient without documentation of the problem. This documentation is also critical for designating priority control areas, identifying infested areas and determining the budget required to do the job. Maps are also a critical component of developing contracts and cooperative agreements that identify areas of responsibility for all parties and define each partner's obligation.

What is the purpose of mapping?

Every map has a purpose. General highway maps are published for the purpose of helping people travel from one city to another. Hydrologic maps are published to show waterways and water flow. Every weed map should have a purpose or goal identified. Some example of weed mapping project goals could be:

- Identify and display outlying populations of a large infestation
- Identify and display small and/or new infestations
- Show estimated size of infestations
- Provide a means for measuring treatment success
- Educate and involve private landowners

By defining the purpose of your map, you can develop a plan for your mapping effort and incorporate this plan into the agency business plan. Assigning short-term goals within the long-term goals will help to keep the momentum of the mapping effort going.

MAPPING AND INVENTORY GUIDELINES

When mapping noxious weeds, the following information should be collected for each infestation site:

Site ID	Weed Species
Infestation Size	Map Symbol
Source	Quad
% Cover	Date
Key Code	Location Description
Ownership	County
State	Country

Data element guidelines

Regardless of the mapping methodology selected, it is recommended that the information listed below be collected for each weed infestation mapped. A general definition is given for each element. Following is the specifics for the data element:

Field Name: Field Type (Field Width, Number of Decimals) *Format: Format description*

Site ID:

- A Site ID is assigned to a weed location and a species. If 2 weed species are in the same location, 2 site IDs are assigned.
- Site IDs are 9 digit numbers and are tracked and maintained by the county supervisor. The first 2 digits are the county number of the county the weed is in. County numbers are assigned alphabetically, e.g. Ada Coounty is 01, Washington County is 44. For a complete list, please see Appendix A.
- The third digit may be a CWMA/work group identifier. For example: 081000001 is Boise Co. UPCWMA work group 1 site 1, 082000001 is Boise Co. UPCWMA work group 2 site 1, and 083000001 is Boise Co. UPCWMA work group 3 site 1. If Boise Co.

were to enter a new CWMA, it may not use 1, 2 or 3 as an identifier, it must start with 4. (County Supervisors: do not repeat identifier.)
- Sequentially number all sites with unique Site IDs.

Site ID: Numeric (10,0)

Weed Species[1]: The scientific or species name. It is composed of genus and species and authority. If codes are preferred, it is recommended that the USDA/NRCS Plants code be used. A list of codes is available at http://plants.usda.gov/plants/index.html. These codes are specific to a plant scientific name.

Weed Species: Text (10)

Infestation Size[1]: Estimated size, in acres, of the infestation (Infested Acres). It is an area of land containing one weed species. An infested acre of land is defined by the actual perimeter of the infestation as defined by the canopy cover of the plants, excluding areas not infested. The minimum area is 0.10 acre.

Infest_Size: Numeric (17,1)

Map Symbol: Which map symbol did you use?
X = Less than 0.1 acre, T = 0.1 to 1 acre, S = 1 to 5 acre, L = Line, A = Area/Polygon

Map_Sym: Text (2)

Source: Who found/treats/last monitored this infestation?

Source: Text (30)

Quad: What is the name of the topographic map this infestation is mapped on?

Quad_Name: Text (40)

% Cover[1]: A percent of the ground covered by foliage of a particular weed species. Enter % values in increments of 10%. For example, estimated % cover of 37% is entered as 40 and estimated cover of 32% is entered as 30. 10% cover is the lowest value.

Per_Cov: Numeric (3,0)

Date[1]: Date when infestation was observed in the field.

Date: Numeric (8,0) Format = yyyymmdd

[1] Indicates required elements of the IWCC guidelines.

Key Code[1]: University of Idaho Code. Format is Species_Year_% Cover. Uses PLANTS code for species and uses 2 digit year and % cover number.

Key_Code: Text (20) Format = Species_year_% cover

Location Description[1]: Location description is very flexible. Latitude and Longitude in degrees, minutes, and second in NAD27 datum is recommended for use by ISDA for GPS location descriptions. You may also use UTM or Township, Range, and Section by standard.

For specific data element information for location, please see Appendix E: IWCC Inventory Mapping Standards, select one location description.

Ownership: General ownership of land the infestation is located. Ownership Codes can be found in Appendix B.

Natl_Own: Text (8)

County: County infestation is located. Recorded as text. County names can be related to FIPS codes (Appendix C).

County: Text (5)

State: State infestation is located. Please us the two digit postal code, e.g. Idaho = ID.

State: Text (2)

Country: Country infestation is located. The two digit abbreviation for the United States of America is UA, Canada is CA.

Country: Text (6)

Guidelines for hand-drawn, maps, GPS, and GIS Entry

Hand-drawn Maps

1) Determine what 1:24000 (7.5 minute) topographic maps cover the area you will map. Obtain the necessary topographic maps from the Bureau of Land Management, Forest Service, or United States Geological Survey. Electronic copies of the maps may be available through ISDA and on the web at www.insideidaho.org.

2) Place weed locations on these maps.
   - For weed infestations of sizes:
     Less than 0.1 acres, use **X**
     0.1 to 1 acre, use **Δ**
     1 to 5 acres use □

[1] Indicates required elements of the IWCC guidelines.

- For weed infestations greater than 5 acres, draw the boundaries of the infestation to scale. These line drawings will be referred to as polygons.

3) Assign Site IDs to all weed locations on the map.

The maps should have weed locations illustrated as described in 2 above and a Site ID assigned to each illustration. Other relevant information will be stored in a field notebook.

4) In a notebook, record for each weed infestation:

Site ID	Weed Species	Infestation Size	Map Symbol	Quad	% Cover	Date	Key Code	Location Description	Ownership	County	State	Country

For and example data sheet, please see Appendix D.

Each Site ID with the associated fields should be included. Use * to indicate a field where information is not known or is not applicable.

5) The maps and field note recorded in a spreadsheet will be used for entering the map locations into GIS.

If you are using GPS units which do not download locations onto a computer, include recorded latitude and longitude as degrees, minutes, seconds in the spreadsheet or field notebook for each infestation. For example: 42 30 20.10 latitude, -116 22 43.12 longitude.

GPS – Nested point procedure for feature mapping

In the last several years, Global Positioning Systems (GPS) have become cheaper and more accessible to the field specialist. Most GPS units will allow for display of latitude and longitude and storage of a waypoint location. Many of the more expensive GPS units are capable of feature mapping. Features in this context are points, lines, and areas where the lines have length and the polygons have perimeters and areas. Many GPS units will record "tracks" where points are linked in sequence. Tracks are generally not considered features because a track cannot be exported to a GIS as a single unit with a designated length.

For a more detailed description of GPS, please see Tools For Noxious Weed Mapping, Global Positioning Systems (page 11).

When using a GPS unit to simply note the latitude and longitude of a location, always record the datum the unit is set in as well. Be certain to also record the other recommended data elements with your location.

If using a GPS unit capable of feature mapping, it is recommended that a nested point procedure be adopted. A nested point procedure requires that for every line or polygon feature recorded, an

associated label point with attributes be recorded as well nested within the feature. Although line and polygon features tend to be more accurate representations of weed infestation boundaries, a GIS is required to view these features. The nested point protocol can be used with or without GIS. Not every entity or partner has direct access to a GIS system. Point information can easily transferred to a flat file or relational database for use by all interested parties. Also, point data is easily transferred from various makes and types of GPS units in the form of waypoint data. Because the Base Map for noxious weed mapping is the USGS 7.5 minute quadrangle, any infestation less than 5 acres may be recorded as a point.

For an example of a data dictionary for use in a nested point protocol, see Appendix E.

Geographic Information Systems (GIS) entry of information

For a general explanation of GIS, please see Tools For Noxious Weed Mapping, Geographic Information Systems (page 14).

The primary coverage should be a polygon coverage. All points and lines should be buffered into polygons. Recommended projection is UTM NAD 27 Clark 1866 ellipsiod. Geographic Coordinates should be maintained as Degrees, Minutes, Seconds in a format of DDD MM SS. All data should be digitized with a maximum RMS (root mean square) error of 0.005,5.

Attribute information should conform to recommendations made under *Data element guidelines (page 4)*.

Metadata

If possible, Federal Geographic Data Committee (FGDC) compliant metadata should be collected with all GIS data. If you are unable to do so, please collect the following information in a text or other document.

1) Project description including how the data was collected.
2) Software used, including version, as well as operating system used.
3) All sources and contributors of data. Maintain a crew and equipment list. Minimal accuracy should be listed with equipment.
4) Range of dates when data was collected.
5) If additional attributes are available to be joined with the included data, list whom to contact to obtain the information. Also list each element describing:
   - Field name
   - General description
   - Field type
   - Width
   - Decimal places
   - Format

   This information may be compiled from the standards used.
6) How complete is the information? What was surveyed that year?
7) What datum and projection was the information collected in? (GIS & GPS)
8) What processing steps were used to develop the coverage? (GIS)

- How was the information digitized? What equipment was used?
- What is RMS error for the quad?
- Modification processes were used? For example: Merge, Union, Intersect, Build.
- Who was responsible for digitizing? Who was responsible for modifying the coverage?

9) What is your best horizontal accuracy? If you were to go out to the field, how close to the actual location is the digital feature? How did you come to this conclusion? (GIS and GPS)
10) Attribute accuracy: How correct are your attributes? How did you reach this conclusion?
11) Who is the primary contact for this information? Who do I contact to receive a copy of the coverage and the metadata? Include all relevant contact information.

DATA STANDARDS USED BY ISDA

The mapping guidelines proposed above are based on two standards: The North American Weed Management Association (NAWMA) Mapping Standards and the recommendations of the Idaho Weed Coordinating Committee (IWCC). The North American Weed Management Association is an international organization with representatives across the United States and within Canada and Australia. The NAWMA standards have been accepted by the national leadership of the Forest Service (USFS), Bureau of Land Management (BLM), National Park Service (NPS), and several other state and federal agencies. The Mapping Subcommittee of the IWCC had representation from The BLM, Region 1 and Region 4 USFS, the University of Idaho, Idaho State Department of Agriculture, and the Idaho Association of County Weed Superintendents. Although the two standards are not exactly compatible, by employing some basic database "tricks", the two standards blend smoothly. To view a summary of the NAWMA standards and the IWCC standards, please see Appendixes F and G.

SUBMITTING DATA TO ISDA

In order to meet the goal of ISDA to provide a picture of weed distributions in Idaho, ISDA will request annual updates of weed location information from county noxious weed control entities, state and federal land management agencies, and other landowners. This information will be used to support statewide control, budget and legislative decisions.

Data sent to the ISDA for incorporation into the statewide data layer should be in the following format:

> *Non-GIS data:* The data should be in either .xls or .dbf format. Latitude, longitude, and datum for each location should be specified. Latitude and longitude should be in degrees, minutes, seconds or decimal degrees. UTM coordinates with zone may be substituted for latitude and longitude. Include information on weed species, infestation size, date, percent cover, general ownership, county, state, and country. For specifics, please review Mapping and Inventory Guidelines (page 4).
>
> *GIS data:* The data should be in either ESRI shapefile format or ESRI ArcInfo coverage format contained in .e00 files. Projections should be UTM zone 11, UTM zone 12, or IDTM. If other projections are used, complete FGDC metatdata file must be included.

Attribute information should include: weed species, infestation size, date, percent cover, general ownership, county, state, and country. For specifics on attribute values, please review Mapping and Inventory Guidelines (page 4).

THE SIGNIFICANCE OF DATA STANDARDS

Protocols are an agreement of how an agency, cooperative, or partners will do something, e.g. how to map plant populations, or how to conduct archeological surveys. Every protocol consists of data standards. Standards are something established for use as a rule or basis of comparison in measuring or judging capacity, quantity, content, extent, value, quality, etc. (Webster's New World Dictionary). Data standards are the specific "hows" once the "whats" have been decided upon. This includes a name and description for what is to be collected and the specific way to collect it. If electronic data exchange between cooperators (internal and external departmental) is desired, the data element type, field width and decimal numbers need to be defined. Specifying data standards allows individuals/groups/agencies to build their own spreadsheets/databases fitting their own needs but knowing that they have all the necessary elements in the right format to send and receive information from their neighbors and cooperators. Data standards allow you to compare apples with apples, not with oranges.

Data standards are extremely important in this age of electronic field data collection, use of Global Positioning Systems, and data transfer over the internet. Not only do data standards allow for consistence within a department regardless of data collection methodology, they also allow for smooth and intelligent transfer of information between stakeholders, cooperators and partners.

Examples of data standard use

1) Data standards used on local level:

One of the primary concepts behind Cooperative Weed Management Areas (CWMAs) in Idaho is the blurring of administrative boarders. Personnel and resources are pooled to allow for more effective weed management. This pooling of resources requires that infestation and control information be shared among landowners. The state standards are a starting point for communication between agencies, private landowners, and contractors to allow for the reaching of common goals. The state standards outline the basic elements everyone needs to be collecting and provide common definitions of those elements. Individual CWMAs add additional elements to the state standards to accommodate their individual program needs.

2) Data standards used on state level:

When a state agency asks for reporting from local or field agencies, it often has little authority to enforce how the data is collected. In Idaho, the Idaho State Department of Agriculture (ISDA) was required to send out lengthy reporting forms or spend significant man hours on interpreting data collected from 44 counties, over 40 Forest Service (USFS) Ranger Districts, 3 Bureau of Land Management (BLM) Districts, and several National Parks and State agencies to obtain a statewide picture of noxious weed distributions. The result was often biased and unreliable because of different interpretations of the required information or data collection methods. The

state standards have helped to simplify this process by providing a common language for data collection in the field, reporting and data consolidation.

3) Data standards used on federal level:
As the NAWMA standards have been adopted by national leadership, they give common ground for data collection and reporting between regional offices and between federal agencies. In the past, it has been frustrating communicating with different branches of the federal government because there was no common methodology for collection of noxious weed information and therefore no consistency in reporting. This problem also occurred at the field office level within the same branch of government. With the incorporation of the NAWMA standards into the state standards, data exchange is simplified to a set of required fields common among the local agencies and field offices as well as between federal agency branches.

4) Data standards used on international level:
Idaho has a shared boarder with British Columbia, Canada. There is a common desire to exchange information on invasive species distributions as well as biological control distributions. When facilitating international relations, it is very important that information be presented in the most consolidated manner. Idaho's neighbors to the North rarely find it amusing having to consolidate information from several United States local, state, and federal agencies. Also, concise information is important when using and analyzing information on an international basis. The NAWMA standards incorporated into the state standards have given Idaho and its neighboring states a common international communication platform for sharing and exchanging information on noxious weeds with our Canadian neighbors.

TOOLS FOR NOXIOUS WEED MAPPING

As there are with many things, there is more than one way to map weeds and many tools available to help to get the job done. Data recording methods for mapping is generally broken down into several categories: maps, photographs, global positioning systems, and remote sensing.

Maps and Photographs
The most basic way to record locations requires using a base map, a compass, and field notes. Locations are marked on the base map and characteristics of the locations are recorded in a field notebook. Common base maps are printed maps. These maps may be topographic maps, plat maps, transportation or highway maps, or even hydrologic maps. Photographs may also be used as base maps. A common type of photograph used is an aerial photograph. These are photographs taken in flight from a plane. They are often in true color. Another type of photograph is a satellite image. These images are very similar to aerial photographs but are taken by satellites in space. Satellite imagery is often orthorectified. Orthorectification is when a photograph is adjusted so that image displacements caused by camera tilt and relief of terrain are removed.

Global Positioning Systems (GPS)
The Global Positioning System is a navigational system based on a constellation of Earth orbiting satellites. A receiver on the ground receives signals from various satellites and position

is determined by measuring distance from the receiver and the satellites in space. Three satellites are needed to triangulate your position and a fourth satellite determines to accommodate clock errors since GPS uses the speed of light to calculate distance. Most GPS receivers are accurate within 10 to 30 meters, depending on quality of the receiver.

All GPS units should have an accuracy rating. The standard often used is root-mean-square (RMS). Look at the horizontal rating, not the vertical. The smaller the RMS, the better the unit. Receiver manufacturers use many accuracy measures. Root-mean-square (RMS) error is the value of one standard deviation (68%) of the error in one, two or three dimensions. 2drms (two-distance root-mean-squared), is twice the radial error standard deviation (95%). Circular Error Probable (CEP) is the value of the radius of a circle, centered at the actual position that contains 50% of the position estimates. Spherical Error Probable (SEP) is the spherical equivalent of CEP, that is the radius of a sphere, centered at the actual position, that contains 50% of the three dimension position estimates. As opposed to 2drms, drms, or RMS figures, CEP and SEP are not affected by large blunder errors making them an overly optimistic accuracy measure.

The error of a receiver can be refined using a process called differential correction. Differential GPS (DGPS) uses a second receiver at a known location to determine exactly what errors the satellite's data contains. That known error is then used to correct the data in a second receiver. This is fairly complex as the errors from all satellites at all times must be tracked. For this to be effective, the receiver at the known location must be fairly close to the second receiver in order to be tracking all of the same satellites at the same time. There are two basic ways differential correction is made. Real time corrections can be transmitted to the receiver in the field or corrections can be recorded by a base station and can be added to the receiver information after returning to the office.

-Real time DGPS

Real time DGPS is where a receiver is attached to the GPS unit. This receiver accepts a correction signal that is incorporated into the location information in the field. This correction signal is provided in several ways. Private DGPS services use leased FM sub-carrier broadcasts, satellite links, or private radio-beacons for transmission. The U. S. Coast Guard maintains a network of differential monitors and transmits DGPS corrections over radio beacons. These beacons cover much of the U. S. coastline and there are several beacons inland as well. The Coast Guard beacons transmit a free signal. Most private DGPS services require a use fee.

-In office DGPS

In office DGPS involves correction of the GPS data after collection in the field. The GPS data is downloaded onto a computer and appropriate base station information is used to correct the information using a software package. A base station is simply a second receiver at a known location where the correction information is available. Base station information can be stored in either a proprietary format or in RINEX, the government standard. What type of base station formats you will use will depend on what your GPS unit will accept.
DGPS removes errors common to both the reference and remote receivers. It will not correct for errors specific to any one unit such as multipath or receiver noise.

When using GPS units with any map or orthophotograph, it is very important to have your GPS unit set to the correct datum. A datum is a model that describes the size and shape of the earth. It includes a geiod, which is a mathematical representation of the earth's surface. Geodetic datums define the size and shape of the earth and the origin and orientation of the coordinate system used to map the earth. Referencing geodetic coordinates to the wrong datum can result in positional errors of hundreds of meters.

All maps are also projected. A map projection is an attempt to portray the surface of the earth or a portion of the earth on a flat surface. The projection is defined in units of measure, usually either feet or meters. Topological calculations are unit specific. Some distortions of shape, distance, direction, scale and area always result from this process. Each projection will have a defined datum. For best accuracy, make certain that your GPS unit is set to the proper datum and units!

Types of GPS Units

There are several types of GPS units available that are designed for different uses. Marine, air, and land navigation units all use the same basic GPS technology but have different features and capabilities specific to their use. Below is a general summary of the three basic types of land navigation units.

No Correction Units:

Yield Units. User cannot alter configuration settings. Receiver accuracy is 30 to 50 meters. Limited data collection, data transfer, or GIS compatibility. No feature data collection. No download or software for in-office correction. Does not have internal data collection computer. May have ability to interface with real-time DGPS or hand held computer technologies.

Estimated Cost Range: $200-$1000

In Office Correction Units/Resource Grade Units:

User is able to control accuracy through configuration settings. Good data collection, data transfer, and GIS compatibility. User can collect point, line, and polygon features and export into various GIS formats. With the use of software, GPS locations can be refined using post-processing differential correction to under 3 meters. Often contain internal data collection computer for use of data dictionaries and are real-time DGPS ready. These units were designed for professional, non-survey grade mapping purposes.

Estimated Cost Range: $2500-$6000

Carrier Phase Units:

These units are very sophisticated and very accurate. Often, 2 units are needed. These units are often accurate to under a foot. These units are survey grade equipment and require extensive training to use.

Estimated Cost Range: Over $10,000

Remote Sensing

Remote sensing is the use of instruments or sensor to "capture" the spectral (light and wavelengths) and spatial (locational) relationships of objects and materials observable at a

distance - typically from above. The primary product of remote sensing is an image. To be effective, remote sensing images must be post processed, ground truthed. There are 2 primary methods of remote sensing:

Aircraft
Remote sensing using aircraft typically consists of adding a camera or other type of sensor to a helicopter or airplane. These sensors can be standard, (just like your Polaroid camera) infrared sensors, (sensors that view the non-visible far red spectrum) multispectral, hyperspectral, thermal, radar, and many other types of sensors.

Satellites
When most people think of remote sensing, they often think of satellite imagery. Several of the same sensors that can be placed on airplanes can be placed on satellites. Satellites just have different sensing challenges. Several different agencies own satellites with remote sensing capabilities. Some remote sensing imagery can be acquired for free from the U.S. federal government. What imagery you purchase will depend on the resolution you need, the type of sensor you need, and the coverage of the satellite.

LIDAR
LIDAR is Light Detection and Ranging. LIDAR uses a laser light beam usually mounted on an aircraft to measure vertical distance. The LIDAR can be set to penetrate water or reflect from land. LIDAR can be used for profiling, looking at vegetation height and canopy cover, or scanning to make 3-D images.

Combining Map Data: Geographic Information Systems(GIS)
Although often considered a mapping tool, a GIS does not provide raw map data. A GIS is a computerized system for the collection, storage, management, retrieval, changing, modeling, analysis and display of spatial data used to create a representation of the real world. Basically, it is a software program that allows you to display and analyze the mapping information you collect on paper maps, photographs, with GPS units or with remote sensors. GIS integrates data from different sources, allowing you to use all of the mapping tools , and to use information created outside of your department. A GIS also allows you to view the same location in many different ways. A GIS will allow you to answer many questions about your map data including:

- Where is a feature?
- What is near a feature?
- Where is the best place to locate something based on criteria?
- Trend analysis - where will it go next?
- Spatial statistics - how much is owned by an owner?
- "What if" modeling

Also, a GIS is an effective way to create a map display of your weed locations and their characteristics. There are several different GIS software packages available with different capabilities. You should consider the following when selecting your software: What is currently being used by your organization? What your partners are using? What data formats will you need to read and send information in? What is most compatible with your tools?

For examples of how to uses these tools and data integration, please see Appendix G.

Appendix A: Site ID Codes

COUNTY	FIRST 2 DIGITS	SITE ID RANGE	COUNTY	FIRST 2 DIGITS	SITE ID RANGE
Ada	01	010000000-019999999	Gem	23	230000000-239999999
Adams	02	010000000-019999999	Gooding	24	240000000-249999999
Bannock	03	010000000-019999999	Idaho	25	250000000-259999999
Bear Lake	04	010000000-019999999	Jefferson	26	260000000-269999999
Benewah	05	010000000-019999999	Jerome	27	270000000-279999999
Bingham	06	010000000-019999999	Kootenai	28	280000000-289999999
Blaine	07	010000000-019999999	Latah	29	290000000-299999999
Boise	08	010000000-019999999	Lemhi	30	300000000-309999999
Bonner	09	010000000-019999999	Lewis	31	310000000-319999999
Bonneville	10	100000000-109999999	Lincoln	32	320000000-329999999
Boundary	11	110000000-119999999	Madison	33	330000000-339999999
Butte	12	120000000-129999999	Minidoka	34	340000000-349999999
Camas	13	130000000-139999999	Nez Perce	35	350000000-359999999
Canyon	14	140000000-149999999	Oneida	36	360000000-369999999
Caribou	15	150000000-159999999	Owyhee	37	370000000-379999999
Cassia	16	160000000-169999999	Payette	38	380000000-389999999
Clark	17	170000000-179999999	Power	39	390000000-399999999
Clearwater	18	180000000-189999999	Shoshone	40	400000000-409999999
Custer	19	190000000-199999999	Teton	41	410000000-419999999
Elmore	20	200000000-209999999	Twin Falls	42	420000000-429999999
Franklin	21	210000000-219999999	Valley	43	430000000-439999999
Fremont	22	220000000-229999999	Washington	44	440000000-449999999

Appendix B: Ownership Codes

Code	Description
ALOT	Native American Allotments
ARS	Agricultural Research Station
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BPA	Bonneville Power Administration
CGOV	County Government
DOD	Department of Defense
EPA	Environmental Protection Agency
FSR	USDA Forest Service Research Station
NBS	National Biological Survey
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRCS	Natural Resources Conservation Service
OTH	Other
PVLA	Private Landowner
SCS	U.S. Soil Conservation Service (pre NRCS)
STAT	State Lands
TNC	The Nature Conservancy
TRIB	Tribal Lands
TVA	Tennessee Valley Authority
UNIV	University Lands
USFS	United States Forest Service
USFW	United States Fish and Wildlife Service
USGS	United States Geological Survey
USOT	U.S. Government (Other Federal Lands)

Appendix C: FIPS Codes

COUNTY	FIPS CODE	COUNTY	FIPS CODE
Ada	001	Gem	045
Adams	003	Gooding	047
Bannock	005	Idaho	049
Bear Lake	007	Jefferson	051
Benewah	009	Jerome	053
Bingham	011	Kootenai	055
Blaine	013	Latah	057
Boise	015	Lemhi	059
Bonner	017	Lewis	061
Bonneville	019	Lincoln	063
Boundary	021	Madison	065
Butte	023	Minidoka	067
Camas	025	Nez Perce	069
Canyon	027	Oneida	071
Caribou	029	Owyhee	073
Cassia	031	Payette	075
Clark	033	Power	077
Clearwater	035	Shoshone	079
Custer	037	Teton	081
Elmore	039	Twin Falls	083
Franklin	041	Valley	085
Fremont	043	Washington	087

Appendix D: Field Data Sheet Example

****

Site ID (optional): _____ Weed Species:_____ Infestation Size:_____Acres

Date: _____ Cover:_____ Key Code:_____

Phenology: _____ Cover Class Desc:_____ # Plants/Units:_____

Contact/Crew:_____ Treated:_____

Select one location description:

Township_____Range_____Section_____1/4 Section___SW___
¼ ¼ or 16 of Section (if known)____NE_____ Meridian _____ Quad Name_____
OR
Latitude _____ Longitude _____ Datum _____ Meridian _____
OR
UTM Easting_____UTM Northing_____Zone_____Year_____

Map Attached? (check one) YES_____ NO_____ Map/GPS Unit:_____

Site ID (optional): _060001235__ Weed Species:____TRTE_____ Infestation Size:___1.2_____Acres

Date: ___06/15/98_____ % Cover:_____20_____ Key Code:__TRTE_98_20_____

Phenology: ___Bud_____ Cover Class Desc:__monoculture___ # Plants/Units:_10/sq ft_____

Contact/Crew:_John Doe_____ Treated:_Chemical_____

Select one location description:

Township_03S__Range_35E____Section__11____1/4 Section___SW___
¼ ¼ or 16 of Section (if known)____NE_____ Meridian _ Boise___ Quad Name_Blackfoot_____
OR
Latitude _____ Longitude _____ Datum _____ Meridian _____
OR
UTM Easting_____UTM Northing_____Zone_____Year_____

Map Attached? (check one) YES__X_____ NO_____ Map/GPS Unit:_1:24000 USGS QUAD__

USDA/NRCS PLANTS CODES
Yellow Starthistle = CESO3 PunctureVine = TRTE Millium = MIVE3
Rush Skeletonweed = CHJU Orange Hawkweed = HIAU White Top = CADR

EXAMPLE SPREAD SHEET

Weed Species	Infestation Size	Date	Cover	Key Code	Latitude	Longitude	Datum	Meridian	Site ID
CESO3	0.7	19980807	50	CESO3_98_50	43 50 15.22	116 45 33.94	NAD27	BOISE	010004589
MIVE3	1.0	19980612	30	MIVE3_98_30	43 22 36.32	116 20 42.32	NAD27	BIOSE	010004590
CHJU	15	19980725	60	CHJU_98_60	43 10 10.44	116 05 10.45	NAD27	BOISE	010004591

Appendix E: Trimble Data Dictionary

Weed Survey
Weed Survey w/ Nested Point Info

Weed Point Point Feature, Label 1 = Date, Label 2 = Site ID Normal, Normal

Date Date, Auto generate Create, Year-Month-Day Format

Site ID Numeric, Decimal Places = 0 Minimum = 0, Maximum = 999999999, Default Value = 0 Normal, Normal

New Site? Menu, Required, Required

- Yes [yes] [yes]
- No [no] [no]

Species Menu, Required, Required

- Canada thistle [CIRAR] [CIAR4]
- rush skeletonweed [CHOJU] [CHJU]
- Russian knapweed [CENRE] [ACRE3]
- spotted knapweed [CENMA] [CEBI2]
- diffuse knapweed [CENDI] [CEDI3]
- yellow starthistle [CENSO] [CESO3
- Scotch Thistle [ONRAC] [ONAC]
- whitetop/hoary cress [CADDR] [CADR]
- field bindweed [CONAR] [COAR4]
- musk thistle [CRUNV] [CANV4]
- purple loosestrife [LYTSA] [LYSA2]
- puncturevine [TRBTE] [TRTE]
- perrenial pepperweed [LEPLA] [LELA2]
- Dalmatian toadflax [LINDA] [LIDA]
- yellow toadflax [LINVU] [LIVU2]
- black henbane [HSYNI] [HSNI]
- leafy spurge [EPHES] [EUES]
- buffalo bur [SOLCU] [SORO]
- common crupina [CJNVU] [CRVU2]
- dyer's woad [ISATI] [ISTI]
- jointed goatgrass [AEGCY] [AECY]
- johnsongrass [SORHA] [SOHA]
- milium [MILSC] [MIVE3]
- orange hawkweed [HIEAU] [HIAU]
- perrenial sowthistle [SONAR] [SOAR2]
- poison hemlock [COIMA] [COMA2]
- Scotch broom [SAOSC] [SYSC4]
- silverleaf nightshad [SOLEL] [SOEL]
- skeletonleaf bursage [FRSTO] [AMTO3]
- Syrian bean caper [ZYGFA] [ZYFA]
- tansy ragwort [SENJA] [SEJA]
- toothed spurge [EPHDE] [EUDE4]
- yellow hawkweed [HIECA] [HICAIO]
- Eurasian watemilfoil [MYPSP] [MYSP2]
- Unknown [U] [U]
- Other [0] [0]

Phenology Menu, Required, Required

- Seedling [S] [S]
- Rosette [S] [R]
- Bud [Bd] [Bd]
- Bolt [B] [B]
- Flower [FL] [FL]
- Mature [M] [M]
- Seed Set [SS] [SS]
- Dead [M] [D]

Sizelnfest Menu, Required, Required

- < .1 acre [X] [.1]
- .1 to 1 acre [T] [1]
- 1 to 5 acres [S] [S]
- Other [o] [o]

Treated? Menu, Required, Required

- No [no] [NO]
- Chemical [C] [C]
- Mechanical [M] [M]
- Biological [B] [B]

Domestic Animal [DA] [DA]

Pecent Cover Class Menu, Normal, Normal

Trace/rare 10 [T] [10]
Low/occ. plts. 10 [L] [10]
Mod./scatt.plts. 20 (M] [20]
30% [H] (30]
40% [H] (40]
High/fairy dense -50 [H] [50]
60% [H] [60]
70% [H] [70]
80% [H] [80]
90% [H] [90]
Very High/dense 100 [H] [100]

Cover Class Desc. Menu, Normal, Normal

monoculture [M] [M]
uniform [U] [U]
satellites [S] [S]
other [O] [O]
linear [L] [L]
isolated [I] [I]

Number of plants Numeric, Decimal Places = 0, Use with units Minimum = 0, Maximum = 1000, Default Value = 0 Normal, Normal

Units Menu, Normal, Normal, Use with number of plants

not applicable [N/A] [N/A]
acres [AC] [AC]
square meter [SQM] [SQM]
hectare [HA] [HA]
square mile [SQMI] [SQMI]
square yards [YD] [YD]
other [O] [O]

Label Pt? Menu, Normal, Normal

Yes [Y] [Y]
No [N] [N]

Offset Direction Menu, Normal, Normal

North [N] (N]
South [S] [S]
East [E] [E]
West [W] [W]
SouthWest [SW] [SW]
SouthEast [SE] [SE]
NorthWest [NW] [NW]
NorthEast [NE] [NE]

Offset Distance Numeric, Decimal Places = 0 Minimum = 0, Maximum = 1000, Default Value = 0 Normal, Normal

Weed Area Area Feature, Label 1 = Date, Label 2 = Site ID

Date Date, Auto generate Create, Year-Month-Day Format, Normal, Normal

Site ID Numeric, Decimal Places = 0, Minimum = 0, Maximum = 999999999, Default Value = 0, Normal, Normal

Weed Line Line Feature, Label 1 = Date, Label 2 = Site ID

Date Date, Auto generate Create, Year-Month-Day Format, Normal, Normal

Site ID Numeric, Decimal Places = 0, Minimum = 0, Maximum = 999999999, Default Value = 0, Normal, Normal

BufferWidth Numeric, Decimal Places = 0, Minimum = 1, Maximum = 999, Default Value = Required, Required

BufferUnits Menu, Required, Required

Meters [M] [M] Default

Yards [Y] [Y]
DirFrmLine Menu, Required, Required
Center [C] [C]
Left [LI [L]
Right [R] [R]

Point Point Feature, Label 1 = Descrip, Label 2 = Notes, Generic point feature
Descrip Text, Maximum Length = 25, Normal, Normal
Notes Text, Maximum Length = 100, Normal, Normal

Line Line Feature, Label 1 = Descrip, Label 2 = Notes, Generic line feature
Descrip Text, Maximum Length = 25, Normal, Normal
Notes Text, Maximum Length = 100, Normal, Normal

Area Area Feature, Label 1 = Descrip, Label 2 = Notes, Generic area feature
Descrip Text, Maximum Length = 25, Normal, Normal
Notes Text, Maximum Length = 100, Normal, Normal

Explanation of ISDA Data Dictionary

A nested point is required for each line and area to attach attributes. The Line or Polygon should have the same Site ID as the associated nested point.

Bold and Underlined fields are minimum requirements. Other fields are optional.

Date: Date inventory/treatment occurred. Automatically inserted – Do Not Alter.
Site ID: GIS linking id. Not established for new weed infestations. This is a nine digit number. A site is considered a distribution of weeds less than 5 m apart and a weed species. Think about how you are going to map the infestation. If you will draw 1 large circle around it, it is 1 site. If you are going to draw many circles, it is many sites. If you are using a line or area to mark a site, the SiteID should be the same for both the line/area and the associated nested point.
New Site? Is it a new site? Yes/No. Allows a check on Site ID.
Species: Which weed species is present. *(Code 2 = USDA/NRCS code system)*
Phenology: What growth stage at that time. Seedling = 2 leaf stage to before horizontal growth. Rosette = Horizontal leaf growth. Bolting = stem elongation, usually vertical. Bud = bud formation to just before opening. Flowering = Any petals seen. Seed Set = Plant has gone to seed and seed dispersal has begun. Maturity = seed dispersal complete. Dead = plant is dead. *(Code 2 = Seedling, S; Rosette, R; Bud, Bd; Bolt, B; Flower, F; Mature,M; Seed Set, SS; Dead, D)*
SizeInfest : How large is the infestation. Patches of weeds less than 5 m apart are one infestation. 3 groupings available: < .1 acre, .1-1 acre, and 1-5 acre. Other is for if the point is a label (nested) point and the sizeinfest will be derived from a line or area (polygon). (*Code 2 = <.1, .1; .1 to 1 , 1; 1 to 5, 5; Other,o)*
Treated?: Did you treat the site? If not, choose no. If yes, by which method. Choose appropriate answer. *(Code 2 = No, No; Chemical, C; Mechanica,M; Biological, B, Domestic Animal, DA)*
% Cover Class: Estimated percent cover. Use 10% increments. The smallest value is 10%.
Cover Class Desc: Subjective measure of weed distribution. M = monoculture, there is nothing but the weed there, U = Uniform, Uniform distribution and size of weed patches, S = Satellite, one main patch with smaller, satillite patches, L = Linear, linear distribution, I = Isolated, isolated patch.
Number of Plants and Units: A type of density measure. Used if you actually measure density. Number of plants is the number, select units used. I.E. Number of Plants: 2 Units: AC means density = 2 plants/AC. If units are N/A, number of plants equals actual number of plants on the site.
Label Pt?: Is the point a nested point of a line or polygon? Yes or No. *(Code 2 = Yes, y; No,n)*
Offset and Offset Distance: Did you need to offset the data? If so, by how much and in which direction? (*Offset Direction Code 2 = North,N; SouthS;, East,E; West,W; Southwest,SW; Southeast,SE; Northwest,NW; Northeast,NE)*
BufferWidth (Lines Only): How wide a buffer on each side of the line is needed to accurately represent the size of the infestation.
BufferUnits (Lines Only): Are you measuring/thinking in yards *(Y)* or meters *(M)*.
DirFrmLine (Lines Only): Is the Infestation on both sides of the road? (Center?) Is the infestation on the left side (Left) or right (Right) side of the road?

Appendix F: NAWMA Standards

NAWMA
For a complete breakdown of the NAWMA standards, please visit http://www.nawma.org

INVENTORY AND MONITORING STANDARDS				
Field Name	***Definition***	***Required?***	***Coding***	***Data Value***
Collection Date	**The date the weed infestation was observed in the field**	**Yes**	**YYYYMMDD**	**Numeric (8,0)**
Examiner	The individual who collected the information in the field, at the site of the infestation	No	Full Name	Alphanumeric (50,0)
Genus	**The genus name of the plant**	**Yes**	**PLANTS database**	**Alphanumeric (20,0)**
Species	**The species name of the plant**	**Yes**	**PLANTS database**	**Alphanumeric (30,0)**
Intraspecific	The intraspecific name of the plant	No	PLANTS database	Alphanumeric (30,0)
Authority	The authority for the scientific name of the plant	No	PLANTS database	Alphanumeric (20,0)
Common Name	The English or Spanish Name of the plant	No	Familiar common name	Alphanumeric (25,0)
Plant Code	A plant code for the scientific name of the plant	No		Alphanumeric (8,0)
Infested Area	**Area of land containing one weed species. Actual perimeter of canopy cover of plants.**	**Yes**		**Numeric (9,2)**
Unit of Meaure	**Unit of measure used to define infested area**	**Yes**	**Hectare or Acres**	**Alphanumeric (9,0)**
Gross Area	Area of land containing one weed species General location of weed	No		Numeric (9,2)
Unit of Meaure	Unit of measure used to define infested area	No	Hectare or Acres	Alphanumeric (9,0)
Canopy Cover	**Estimate of percent of ground covered by foliage of a particular weed species**	**Yes**		**Numeric (3,1)**
National Ownership	**Broad category of land ownership where infestation is located**	**Yes**	**Appendix C**	**Alphanumeric (8,0)**
Local Ownership	Specific land ownership where infestation is located.	No	Familiar local codes	Alphanumeric (10,0)
Source of the Data	**Contact point for questions regarding the data**	**Yes**	**Appendix C**	**Alphanumeric (5,0)**
Country	**Nation or country infestation is located**	**Yes**	**MX, CA, US**	**Alphanumeric (6,0)**
State_Provinc e	**State or province infestation is located**	**Yes**	**Appendix D**	**Alphanumeric (2,0)**
County_ Municipality	**The county or municipality were infestation is located**	**Yes**	**Appendix E**	**Alphanumeric (5,0)**
HUC_ Number	**Unique number assigned to major watersheds**	**Yes for aquatics**	**http://www.e pa.gov/win/a**	**Numeric (12,0)**

			ddress.html	
Quad Number	The identification number of the quadrangle map 1:24,000 or 1:25000	No	On map	Alphanumeric (15,0)
Quad Name	The identification name of the quadrangle map 1:24,000 or 1:25000	No	On map	Alphanumeric (40,0)
Location		**Yes - Select one of 4 methodologies**		
Legal				
1/4,1/4,1/4,1/4				Alphanumeric (2,0)
1/4,1/4,1/4				Alphanumeric (2,0)
1/4,1/4	10 acre piece of a section			Alphanumeric (2,0)
quarter section	40 acre piece of a section			Alphanumeric (2,0)
Section	The section of the township		01-36	Alphanumeric (2,0)
Range				Alphanumeric (6,1)
Township				Alphanumeric (6,1)
Meridian	merdian township designation is based on			Alphanumeric (2,0)
Metes and Bounds				
Metes and Bounds	Written description of the boundaries			Alphanumeric (200,0)
Latitude & Longitude				
Latitude degrees				Alphanumeric (2,0)
Latitude minutes				Alphanumeric (2,0)
Latitude seconds				Alphanumeric (2,2)
Latitude direction				Alphanumeric (1,0)
Longitude degrees				Alphanumeric (2,0)
Longitude minutes				Alphanumeric (2,0)
Longitude seconds				Alphanumeric (2,2)
Longitude direction				Alphanumeric (1,0)
Datum	Datum latitude and longitude were read in.			Alphanumeric (15,0)
UTM				
UTM Easting				Alphanumeric (10,2)
UTM Northing				Alphanumeric (8,2)
UTM Zone				Alphanumeric (5,0)
UTM Year				Alphanumeric (4,0)

Appendix G: IWCC Inventory Mapping Standards

IWCC INVENTORY MAPPING STANDARDS:

Baseline Map 1:24000 USGS Topographic Map

Map data as polygons (areas) at earliest level of data management.

If time, budget, or other considerations do not allow for original mapping of polygons on map or while using GPS unit, an infestation size must be included with all points and lines. Lines must include a buffer width and direction.

Committee Opinion On Weed Complexes:

It is the recommendation of this committee that mapping more than one weed within a single polygon be avoided. True mixing of weed species in one location is considered rare and is often more of a reflection of the accuracy of the mapping technique, not the actual weed population distribution. If more than one weed species is mapped in one location, it is recommended that a second data layer (or more) is created to accommodate the duplication of location and GIS is used to indicate overlap.

REQUIRED DATA ELEMENTS:

Definitions:

Weed Species: Use USDA/NRCS PLANTS CODE to indicate genus and species of plant.

Infestation Size: How large is the infestation/population in acres? Minimum value is 0.1 acre

Date: Date inventory occurred

% Cover Class: Estimated percent cover. Enter % value in increments of 10%. Round to nearest 10%. Lowest value is 10% For Example: Estimated % cover of 37% is entered as 40.

Key Code: General polygon identifier. Combination of species, year and % cover.

Select one location description:
Township, Range, Section, ¼ Section, ¼ ¼ Section or 1/16 Section, Quad Name: PLSS location description. ¼ ¼ Section or 1/16 Section is not required if unknown. Identifies USGS quad. location is on.
OR
Latitude, Longitude, Datum, Meridian: Location description. Use degrees, minutes and second. No need to specify direction in Idaho.
OR
UTM Easting, UTM Northing, UTM Zone, UTM Year: UTM location description.

	Data Type	Width	Decimal	Format	Notes:
Weed Species	Text	10	N/A		USDA/NRCS PLANTS Code
Infestation Size	Numeric	17	1	Real	Minimum value = 0.1 Acre
Date	Numeric	8	0	yyyymmdd	i.e. 06/02/99 = 19990602
% Cover	Numeric	3	0		Enter % value in increments of 10%. Round to nearest 10%. For Example: Estimated % cover of 37% is entered as 40.
Key Code	Text	20	N/A	Species_year_ % Cover	Uses Plants code for species and use 2 digit year.
Select one location description, either TRS, Lat/Long or UTM, then follow the listed format.					
Township	Text	5	N/A	TTPD	T = township #; P = Partial Township, 0 = full township, 1 = ¼ township, 2 = ½ township, 3 = ¾ township; D = direction (N or S)
Range	Text	5	N/A	RRPD	R = Range #; P = Partial Range, 0 = full Range, 1 = ¼ Range, 2 = ½ Range, 3 = ¾ Range; D = direction (N or S) Example: full range R12E is entered 120E
Section	Text	5	N/A		Enter number 1 to 36
¼ Section	Text	5	N/A		Field is called SUBDIV Southwest quarter = SW
1/16 Section or ¼ ¼ Section (If known)	Part of ¼ section description				Northeast ¼ of the southwest ¼ = NESW in the SUBDIV field. The ¼ ¼ is listed first.
Meridian	Text	10	N/A		
Quad Name	Text	50	N/A		Name on USGS 1:24000 topographic map.
Latitude	Text	10	N/A	DDD MM SS	D = degrees, M = minutes, S = seconds
Longitude	Text	10	N/A	DDD MM SS	D = degrees, M = minutes, S = seconds
Datum	Text	10	N/A		
Meridian	Text	10	N/A		
UTM Easting	Numeric	8	2		
UTM Northing	Numeric	8	2		
UTM Zone	Text	50	N/A		
UTM Year	Numeric	4	0		

Text = Alphanumeric and/or String

RECOMMENDED DATA ELEMENTS

Definitions:

Site ID: Unique site identifier and GIS linking id. Not established for new weed infestations. A Site ID is assigned to a location and a species. Hence if there are 2 species in one location, 2 Site IDs are assigned.

	Data Type	Width	Decimal	Format	Notes:
Site ID	Numeric	9	0		First 2 digits are county number. For Example: Ada = 01, Washington = 44.

Text = Alphanumeric and/or String

METADATA

Map/GPS Unit: What map or GPS equipment was used?

Contact: Individual to contact if there is a question.

Appendix H:Examples of tool use and data integration

1) Windshield Sighting
   Earlier in the year, a county required that all employees with field responsibilities attend a four hour weed identification and reporting training. Later that year, the chief mechanic is driving back to the shop from the tire store. Tansy Ragwort is considered a noxious weed in his county and he thought he saw some along the road as he was returning to the shop. As he passes the plants he resets his trip odometer. All that he has in the cab within reach is the brown paper bag from his lunch and a pen. He notes the distance from the infestation to the next mile marker. As he continues on, he writes down the plant, the approximate size of the area he saw, the mile marker and distance from the plants to the mile marker, and the date. He even notes his best guess of plant cover as he was trained to do earlier in the year. Three days later he finds the bag and hands it to the county vegetation manager. The vegetation manager pulls out the highway map, finds the mile marker and back tracks to the location of the infestation. Using the UTM grid on the map, she approximates the coordinates of the location and notes what state and county it is in. She also looks up the scientific name of Tansy Ragwort. Then, she enters the sighting into her database. She notes that the infestation is on Forest Service (USFS) land and forwards a copy of the record to the USFS weed specialist. The USFS specialist easily integrates the information into his database because both the county and the USFS district office are using the same standards. The weed specialist than schedules his weed control crew to verify the information and eradicate the infestation.

2) Hand Mapping
   As the trail crew is repairing the trail from Succor Creek Campground to Bonneville Campground, the trail boss has assigned one of the crew to inventory the vegetation within 10 meters of each side of the trail for a wildflower brochure. If any noxious weeds are found, the location is to be noted on a 1:24,000 topographic map. Species, the infested area, and other information are to be recorded in a field notebook. The information to be recorded in the notebook was determined by identifying state, federal and local standards. When the inventory is complete, the notebook and maps are turned over to the area botanist. The area botanist notes the county, state, and country the trail is in and adds the information to other weed inventories done that year. That information is then forwarded to the operations manger in charge of the spray crew, to the county weed control superintendent for inclusion in the countywide map, and to the District Botanist for use in the next fiscal year planning. Because standards were used, both the district botanist and the county weed control superintendent can interpret the information and integrate it into their database systems.

3) GPS Mapping
   The county noxious weed specialist has hired four student interns to map portions of his county. He plans to split the interns into 2-member crews. Through an education grant, he has obtained 2 GPS units with in-the-field data collection capabilities. In order to make certain that the students are collecting the same information, he uses the state recommended standards to develop his electronic data collection form. The same form is loaded onto the 2 GPS units and the students are trained using the standard definitions. Half way through the

year, the nearby state park would like to use one of the crews for a week. The park also uses the state standards therefore no extra training is required and the same electronic data entry form is used. At the end of the week, the students email the corrected GPS file to the park's vegetation manager and continue on their county survey. At the end of the year, the park data is combined with the county data to display noxious weed infestations in and around the state park.

4) Entering into GIS
The GIS analyst has just been informed that the noxious weed information for her management area will be stored in a GIS database. This database will be used to look at weed spread and assist with yearly management planning. She has received paper maps of infestation locations and a spreadsheet of weed information including latitude and longitude. The information has been taken over several years and by various people. The information is often fragmented and incomplete. The noxious weed specialist gives the GIS analyst the state standards as an example interchange format. After many discussions, the field staff began to use the state standards for data collection. The GIS specialist bases the GIS database on the standards and begins to enter the historic information. Not everything will fit, but with some assumptions, a usable database is created. At the end of the field season, the noxious weed specialist gives the GIS analyst the current information and it is quickly entered into the database. Also, a nearby county wishes to use the database to store its information. The county was using the state standards to collect GPS weed information earlier that year. The GIS analyst matches the GPS information to her GIS and incorporates the information. Later that year, the nearby university would like to use the information combined with other information in a research project. The data is easily transferred and combined because all contributors to the university project are using the state standards.

Appendix I: Starting a mapping project

Step 1: Determine your goals

When starting a mapping project, it is very important to set goals. Your map should be much more than a pretty picture. It should help you reach your overall noxious weed program goals. Some examples of mapping project goals are:

- Monitor infestation size over time.
- Identify outlying populations of a large infestation.
- Identify small and/or new infestations.
- Estimate size of infestations.
- Provide a means for measuring treatment success.

Once you have decided on your mapping goals, consider what it will take to reach these goals. Think generally. What do you need to know? Will you need the size of each infestation, the location of each infestation, the species? Select priority areas. You can only "eat an elephant one bite at a time." Also, think in terms of analyzing and displaying your information. Will you need the exact boundaries of each infestation or can you simply use a general location. Can you satisfy more than one goal with the same information? Will your information be shared with other groups/departments/agencies? Do you need to consider another group's practices and standards? What scale (regional, statewide, countywide, city wide, or parcel specific) and accuracy (how precise the information is at the defined scale) is required?

Step 2: What information is out there?

Now that you have defined your goals and the requirements of those goals, you need to figure out what information is already available. Ask the following questions:

1) What maps already exist in your own jurisdiction?
2) What information is in other areas, departments, or agencies?
3) What does the staff know?

Verification of the information given is often required but this general information can help to guide your mapping efforts.

Next, you need to ask, what would it take to make them all the information comparable? Sometimes this is as simple as putting all of the dots from all of the different sources on the same paper map. Usually, the process is slightly more complicated and often involves some computer work. Once you have all of the pre-existing data, you can narrow down what information is missing to reach your project goals and where you need to collect data.

Step 3: Review goals

At this point, it would be beneficial to reevaluate the goals of your mapping project. Data creation is one of the most costly aspects of any project and you now have an idea of what information is already available and what you will need to do to reach your goals. Please consider:

- Can you realistically meet the mapping goals?
- What is the annual budget?
- What is the long-term budget forecast?
- Do you have the required personnel or will you need to hire?

- What is the timeline
- What mapping tools do you want to use?
- Do you have the proper equipment? What will your computer needs be to reach these goals? Do you have the proper hardware and software? What future upgrades can be expected?
- Will training need to be scheduled?
- Are there other organizations that share your goals and therefore can become partners? Do these partners have resources you need? Outline each partner's responsibilities.

Step 4: Plan how you will reach your goals

Now that your goals have been refined, you must plan your mapping effort. As with most things, there is more than one way to map weeds. Assign responsibility for goal completion to specific individuals. Define yearly and daily goals and identify how they fit into the overall project goals. Determine when you will need to be mapping for the best results. Also, plan for post-mapping data input and for accepting information from other reliable sources. Information must be verified, synthesized, and made accessible before it can become useful. Incorporate the mapping effort into the Strategic Plan for your department.

Additionally, incorporate mapping into the routine. Many other members of your department may be able to assist with the mapping. Highway crews, trail crews, fence crews, botanists, and other professionals can be charged with being on the look-out for noxious weeds. Also, mapping does not always have to be a stand-alone job. The person primarily responsible for mapping can also pull hose or provide other support to the spray crew, check to see if roads are drivable, or be responsible for photo point establishment and photo record.

Now that you have set your mapping goals, incorporated those goals into the strategic and annual work plans, design your projects, and assigned responsibility for mapping goal completion, it is time to start mapping!

Appendix J: References

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